

for the whole country in cases of obscurity. And it may be said, all these are possible with the whole-time clinical professors. I doubt it. The ideals would change, and I fear lest the broad spirit which has characterized the school should narrow, as teacher and student chased each other down the fascinating road of research, forgetful of those wider interests to which a great hospital must minister.

Take the money by all means but use it:

1. To reduce the number of students.

2. To rearrange the laboratories in accordance with Alternative Scheme II.

But lastly and chiefly, divert the ardent souls who wish to be whole-time clinical professors from the medical school in which they are not at home to the Research Institutes to which they properly belong, and in which they can do their best work.

Believe me, my dear Remsen,

Sincerely yours,

WILLIAM OSLER

Oxford,
September 1, 1911.

SPECIAL ARTICLE

Smallpox — A Retrospect

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SMALLPOX is one of the oldest diseases known to man. It is believed to have been endemic in China several centuries before Christ and subsequently occurring in Europe. Its spread was facilitated by means of the large movement of itinerant soldiers and others during the Crusades, and by the beginning of the sixteenth century had gained a firm foothold in most parts of the then-known world. But it was not until the reign of James I that smallpox became known as a killing disease in England. Prior to this time it was confused with measles. A sister and a brother of Charles II died from it in 1660, and Queen Anne contracted the disease in 1677. The virulence of the infection increased greatly at the beginning of the eighteenth century and this was largely responsible for the public and medical interest in the disease.

During the Byzantine period several references were made to outbreaks of smallpox. Eusebius, Bishop of Caesarea, described a Syrian epidemic in 302 A.D., and the term "variola" was first used by Marius, Bishop of Avenches, in 570 A.D. *The Ishinho*, the oldest Japanese medical text written by Yasuhori Tamhu in 982 A.D., records the existence of isolation hospitals for smallpox victims. However, the earliest known medical text devoted to smallpox and measles was written by Rhazes about the year 910 A.D. It was translated from the original Arabic into Syriac and later into Greek. The first Latin translation by Giorgio Valla appeared in 1498, being published in Venice. A Latin

ABSTRACT

Smallpox has been known as a disease of man since the earliest times. However, its severity increased greatly during the eighteenth century, stimulating physicians and others to find methods of protection against it. Variolation (the inoculation of smallpox material into the skin) was tried, and for a while found general approval, although its practice was not without danger. In 1796, Edward Jenner began his investigations into the use of cow-pox material (vaccination) as a prophylactic against smallpox, and later showed that vaccination could confer protection. Although vaccination centres were first set up in Canada early in the nineteenth century, the disease on occasion assumed epidemic proportions, such as occurred in Montreal in 1885. Sporadic outbreaks have occurred since then, including the recent case in Toronto. From the public health point of view, maintenance of a high level of immunity to smallpox throughout the general population is necessary if serious epidemics are to be avoided.

translation of Rhazes by the Rev. Dr. Thomas Hunt was given at the end of Richard Mead's work on the same diseases entitled "De Variolis et Morbillis Liber", 1747. This served as the text for the first English version written by John Theobald, printed in London in the same year. The work has been translated into many languages over the years, and an edition in English was published by the

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Sydenham Society in 1848, translated from the original Arabic by W. A. Greenhill. The contagious nature of the disease was for centuries little understood. Gilbertus Anglius (d. 1250), in his "Compendium Medicinæ", was the first to refer to smallpox as a contagious disease, a view afterwards contradicted, even by Sydenham, who attributed it to a specific inflammation of the blood. He, nevertheless, made great contributions to the treatment of the condition. Herman Boerhaave (1668-1735) was the first to prove conclusively that smallpox is spread only by contagion.

Although it had been practised since time immemorial, prophylaxis against the disease by inoculating material from the smallpox pustules into the skin of the unaffected individual (variola-tion) was first reported in the medical literature by Heinrich Vollgnad (1634-1682) in his work "Globus Vitulinus", published in 1671. It is in this book that the term "variola-tion" first occurs. Emmanuel Timoni and Giacomo Pylarini, in communications to the Philosophical Transactions of the Royal Society (1714-1716), described methods that could be employed for the prophylaxis against smallpox. Their ideas achieved wide acclaim in England and were subsequently advocated in 1717 by Hans Sloane, who was later elected President of the Royal Society. In the following year, Lady Mary Wortley Montagu, wife of the British Ambassador in Turkey, had her three-week-old son inoculated in Turkey; and through her influence the procedure became fashionable in England and elsewhere. The Princess of Wales had her two daughters inoculated; and by 1746, institutes such as the Middlesex County Hospital for smallpox at Windmill Street and at Bethnal Green were set up. In America, Zabdiel Boylston on June 26, 1721, at Boston successfully inoculated his son and two Negro slaves with pustular material from a smallpox case during a current epidemic, and similarly inoculated over 2000 others before the epidemic abated. However, of those inoculated, 30 died as a direct result of the inoculation. As a result of these deaths there was a great deal of public opposition to Boylston and, in particular, by a physician, William Douglass, who wrote vehemently of the dangers attendant upon such procedures in his two books "Inoculation of the Small-pox as Practised in Boston" and "The Abuses and Scandals of Some Late Pamphlets in Favour of Inoculation of the Small-pox", both published by Benjamin Franklin in 1722. James Kilpatrick of Charleston, S.C., inoculated nearly 1000 people, of whom eight subsequently died as a result of the inoculation. His method differed from that of his predecessors in that he attempted to attenuate the virus by the use of successive arm-to-arm inoculations, a method which on occasion transmitted syphilis and tuberculosis. In England, Sutton used a similar method and he and his assistant inoculated over 28,000 people between 1766 and 1768 with very little mishap. However, in England variola-tion was pro-

hibited by the Act of 1840. Benjamin Franklin, who favoured variola-tion, published "Some Account of the Success of Inoculation for the Small-pox in England and America" in 1759, at London. Thomas Dimsdale (1712-1800), a Quaker physician, inoculated Catherine of Russia and her son, and other members of the royal household at St. Petersburg in 1768, for which services he received a present of £12,000 and a pension for life of £500, being also rewarded with the rank of Baron of the Empire, Counsellor of State and Physician to the Empress. He later opened a banking house in Cornhill, in the City of London, which still exists.

Although the method of variola-tion gained an initial popularity, it soon fell into disfavour, as there was a very definite risk attached to its use. Towards the middle of the eighteenth century attempts were made to revive this method of inoculation, but only with limited success.

In 1774, cow-pox was first inoculated into a human being for the prophylaxis of smallpox by Benjamin Jesty, a Dorset farmer, who vaccinated his wife and two sons; and in 1789 Jenner inoculated his young son with swine-pox material. The rationale for the use of this method was based on chance observation alone and not upon scientific investigation. Edward Jenner, who lived and practised in Berkley, Gloucestershire, England, and others before him had made the observation that dairymaids who had contracted cow-pox through milking did not get smallpox. On May 14, 1796, Jenner commenced his investigation by performing the first vaccination on a boy named James Phipps, using pus from the arm of a milkmaid, Sarah Nelmes. He later tested the efficacy of his method by inoculating the boy with smallpox material and found that he was unable to produce a reaction. By 1798, he had vaccinated 23 persons, none of whom had subsequently contracted smallpox. In this year he published his classic "An Inquiry into the Causes and Effects of the Variolæ Vaccinæ". Jenner's work was continued by Woodville and Pearson, and Jennerian vaccination soon became universally adopted, though not without a great deal of prejudice, which is still evident at the present day, finding such distinguished adversaries as George Bernard Shaw. Jennerian vaccination was first introduced into North America by Benjamin Waterhouse and by John Coxe in 1802. The first compulsory vaccination Act for England and Wales was passed in 1853. It enacted that vaccination should be performed within three to four months of birth. Compulsory vaccination laws were passed for Scotland and Ireland in 1863. The Act of 1853 was followed by the Act of 1867 which empowered Boards of Guardians to appoint Vaccination Officers, this appointment being made compulsory by another Act in 1871. In the last quarter of 1869 an epidemic of smallpox broke out in France: the disease rapidly spread and by 1870 it was pandemic. Although this epidemic was one of the worst that England had ever suffered, the

annual death rate was about one-third that occurring in prevaccination times.

With the advent of improved bacteriological techniques in the late nineteenth century, some progress was made in delineating the morphology of the infecting agent. John Brown Buist in 1887 demonstrated the presence of elementary bodies, later described by Paschen in 1906; and in 1893, Guiseppe Guarnieri described inclusion bodies found in the specific lesions of smallpox (*Cytorthyctes variolae*) which he believed to be the causative organism. Copeman, in his Milroy Lectures for 1898, described bacteriological findings which finally established the validity of vaccination as a preventive of smallpox. Tests for the diagnosis of smallpox were devised by Paul in 1915, Mervyn Gordon 1925, Ledingham 1926, and Neil E. McKinnon and Robert D. Defries in 1928.

Smallpox had always been prominent in Canada, especially in the seaports, and on numerous occasions the North American Indians have been decimated by the disease. The Hôtel-Dieu Hospital in Quebec City was originally opened for the care of smallpox victims in 1639. The following year saw the beginning of a series of epidemics among the Indians and others along the hinterlands of the lower St. Lawrence and northern Maine. During the first decades of the eighteenth century, numerous serious epidemics occurred in Quebec, New England, the Carolinas and elsewhere along the Atlantic seaboard. In 1702 an epidemic killed over 3000 in Quebec alone, and by 1721 Boston had witnessed six major epidemics. Following this, there were few major outbreaks in Canada until 1783, when the disease once again reached epidemic proportions and over 1000 fatalities were recorded.

The introduction of Jennerian vaccination into Canada in the early 1800's kept the disease under some control. The success of this method became well established, and in 1821 a grant of £1500 was obtained for the promotion of Jenner's system of vaccination in Quebec. Although smallpox was more or less epidemic throughout Eastern Canada in the nineteenth century, vaccination was not compulsory and re-vaccination was seldom carried out or thought necessary. After the introduction of the British North America Act, legislation was in force in Quebec requiring that all hospitals receiving provincial grants should admit smallpox cases. The admission of these patients often led to the dissemination of the disease throughout the hospital and its environs. (Osler, who later contracted the disease himself, records that during the period December 14, 1873 to July 21, 1875, 260 cases of smallpox were admitted to the Montreal General Hospital.) At this time the danger of the spread of the disease was aggravated because of the militant and sometimes violent public hostility towards vaccination. In many areas variolation was still used as a means of protecting children against a generalized attack of smallpox, and in England numerous instances of convictions for manslaughter

are recorded against parents whose children died as a result of the wilful direct transmission of the disease by variolation. The medical periodicals of the time also record that variolation had been used as an instrument of murder and of suicide.

Although smallpox had been prevalent in Montreal between 1870 and 1875, it died out, in part owing to the exhaustion of suitable material and in part owing to the use of the Jennerian system of vaccination. However, on February 28, 1885, a Pullman-car conductor, who had travelled from Chicago, where the disease was sporadic, became ill and was admitted to the Hôtel-Dieu, Montreal, a general hospital. The patient was not isolated and on April 1, a servant in the hospital died of smallpox. After her death, the hospital authorities dismissed all patients not showing signs of the disease who were able to return to their own homes. The disease was thus enabled to spread rapidly throughout Montreal and the surrounding countryside and nearly 20,000 cases were reported; 3164 patients died within the city in nine months. It is recorded that 2717 of these were children under 10 years of age. Since this time many isolated cases and a few serious outbreaks of smallpox have occurred throughout Canada. In 1921, 1352 cases were reported at Ottawa; however, on this occasion the disease ran a comparatively benign course and there were few deaths. A serious epidemic occurred at Windsor in 1924, in which there were 32 deaths in the 67 cases reported. Failure to apply proper decontamination procedures in the case of visitors to a quarantined case at Halifax in 1937 led to a serious spread of the disease, during which several fatalities occurred. An isolated case was reported from British Columbia in 1937 and a suspected case from Truro, Nova Scotia, in 1949, where an American visitor was involved. These cases were rigidly quarantined and no dissemination of the disease occurred.

Vaccination has greatly reduced the incidence of smallpox, but in spite of this the disease is still prevalent in many parts of the world. Rapid transit between one country and another, often widely separated, brings with it the danger of the spread of acute infections such as smallpox. If, throughout the general population, the level of immunity conferred by vaccination becomes reduced through ignorance or indifference, an episode such as has recently occurred in Toronto may well have disastrous consequences. Foci of infection still exist, particularly in India, Pakistan, Brazil and Ecuador. Extensive vaccination programs undertaken by the Pan American Health Organization in association with the member governments have resulted in the eradication of smallpox from some South American countries, such as Peru and Venezuela. In others, such as Colombia, vaccination programs have been able to cut down the incidence of the disease by as much as 95%. The present case in Toronto originated in Brazil, where smallpox and alastrim are highly endemic, especially in rural areas.